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ABSTRACT

The goal of this panel was to develop the means to improve the reliability, validity, and utility of analyses of human interaction in learning settings. Research on interaction itself, as well as its association with the variables of student learning, student characteristics, setting characteristics, and teacher education were all concerns of this panel. The panel organized its work around needs in teaching as human interaction, and proposed three research approaches based on these needs. The panel's discussion focused on these approaches as well as the organization of specific programs and projects under them. The first approach concerned research on human interaction within education settings, the goal of which was the creation of knowledge and understanding of the process of teacher-pupil and pupil-pupil interactions during teaching and learning. Research on teacher education, which builds on the knowledge developed in research on teaching as human interaction, was the second approach. The third approach dealt with issues of methodology, instrumentation, and professional communications, and focused on the special difficulties of research on teaching as human interaction. Finally, the panel emphasized the need for taking into account the ways in which teachers will adapt research-based knowledge and teaching skills to their own classrooms, students, and styles. Such adaptations will determine the validity and utility of the knowledge to be derived from research on teaching as human interaction. (BD)

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NIE CONFERENCE ON STUDIES IN TEACHING

PANEL 2

TEACHING AS HUMAN INTERACTION

GOAL STATEMENT

To develop the means to improve the reliability, validity, and utility of analyses of human interaction in learning settings.

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Washington, D.C.
December, 1974

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PREFACE

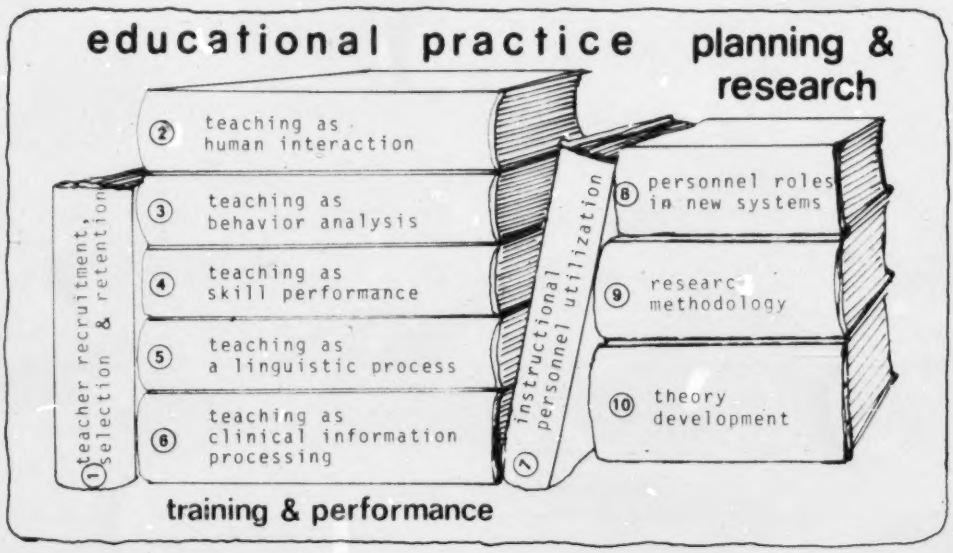
The volume before you is the report of one of ten panels that participated in a five-day conference in Washington during the summer of 1974. The primary objective of this Conference was to provide an agenda for further research and development to guide the Institute in its planning and funding over the next several years. Both by the involvement of some 100 respected practitioners, administrators, and researchers as panelists, and by the public debate and criticism of the panel reports, the Institute aims to create a major role for the practitioner and research communities in determining the direction of government funding.

The Conference itself is seen as only an event in the middle of the process. In many months of preparation for the Conference, the staff met with a number of groups -- students, teachers, administrators, etc. -- to develop coherent problem statements which served as a charge to the panelists. Panel chairmen and others met both before and after the Conference. Several other panelists were commissioned to pull together the major themes and recommendations that kept recurring in different panels (being reported in a separate Conference Summary Report). Reports are being distributed to practitioner and research communities. The Institute encourages other interest groups to debate and critique relevant panel reports from their own perspectives.

The Conference rationale stems from the frank acknowledgment that much of the funding for educational research and development projects has not been coordinated and sequenced in such a way as to avoid undue duplication, yet fill significant gaps, or in such a way as to build a cumulative impact relevant to educational practice. Nor have an agency's affected constituencies ordinarily had the opportunity for public discussion of funding alternatives and proposed directions prior to the actual allocation of funds. The Conference is thus seen as the first major Federal effort to develop a coordinated research effort in the social sciences, the only comparable efforts being the National Cancer Plan and the National Heart and Lung Institute Plan which served as models for the present Conference.

As one of the Conference panels points out, education in the United States is moving toward change, whether we do anything about it or not. The outcomes of sound research and development -- though only a minute portion of the education dollar -- provide the leverage by which such change can be afforded coherent direction.

In implementing these notions for the area of teaching, the Conference panels were organized around the major points in the career of a teacher: the teacher's recruitment and selection (one panel), training (five panels), and utilization (one panel). In addition, a panel was formed to examine the role of the teacher in new instructional systems. Finally, there were two panels dealing with research methodology and theory development.



Within its specific problem area, each panel refined its goal statement, outlined several "approaches" or overall strategies, identified potential "programs" within each approach, and sketched out illustrative projects so far as this was appropriate and feasible.

Since the brunt of this work was done in concentrated sessions in the space of a few days, the resulting documents are not polished, internally consistent, or exhaustive. They are working papers and their publication is intended to stimulate debate and refinement. The full list of panel reports is given on the following page. We expect serious and concerned readers of the reports to have suggestions and comments. Such comments, or requests for other panel reports, should be directed to:

Assistant Director
Program on Teaching and Curriculum
National Institute of Education
1900 M Street, N.W.
Washington, D. C. 20208

As the organizer and overall chairman for the Conference and editor for this series of reports, Professor N. L. Gage of Stanford University richly deserves the appreciation of those in the field of teaching research and development. The panel chairpersons, singly and together, did remarkable jobs with the ambitious charge placed before them. Special acknowledgments are due to Philip Winne of Stanford University and to Arthur Young & Company for coordination and arrangements before, during, and after the Conference. But in sum toto, it is the expert panelists -- each of whom made unique contributions in his respective area -- who must be given credit for making the Conference productive up to the present stage. It is now up to the reader to carry through the refinement that the panelists have placed in your hands.

Garry L. McDaniels
Program on Teaching and Curriculum

LIST OF PANEL REPORTS AND CHAIRPERSONS

1. Teacher Recruitment, Selection, and Retention, Dr. James Deneen, Educational Testing Service
2. Teaching as Human Interaction, Dr. Ned A. Flanders, Far West Laboratory for Educational Research and Development
3. Teaching as Behavior Analysis, Dr. Don Bushell, Jr., University of Kansas
4. Teaching as Skill Performance, Dr. Richard Turner, Indiana University.
5. Teaching as a Linguistic Process in a Cultural Setting, Dr. Courtney Cazden, Harvard University
6. Teaching as Clinical Information Processing, Dr. Lee S. Shulman, Michigan State University
7. Instructional Personnel Utilization, Dean Robert Egbert, University of Nebraska
8. Personnel Roles in New Instructional Systems, Dr. Susan Meyer Markle, University of Illinois
9. Research Methodology, Dr. Andrew Porter, Michigan State University
10. Theory Development, Dr. Richard Snow, Stanford University

• Conference on Studies in Teaching: Summary Report, Dr. N. L. Gage, Stanford University

INTRODUCTION

When research on teaching is viewed as human interaction, it can be represented by the six classes of variables which are shown in Figure 1.

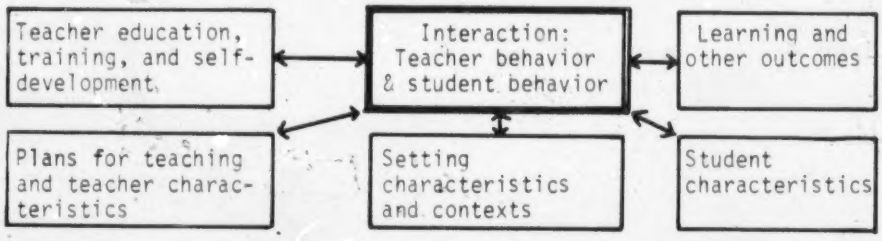

Teacher education, training, and self-development
Interaction: Teacher behavior & student behavior
Learning and other outcomes
Plans for teaching and teacher characteristics
Setting characteristics and contexts
Student characteristics

Figure 1. Main Classes of Research Variables.

We included, as the concern of Panel Two, any research on teaching that analyzes the interactive behavior of pupils and teachers shown in the top, center box in Figure 1. Thus, research on the interaction itself, and the associations of interaction variables with student learning and other outcomes, with student characteristics, with setting characteristics, with making plans for teaching, with teacher characteristics, and with teacher education are the concern of this Panel.

The analysis of human interaction and especially teacher-pupil interaction is of concern to this Panel in two ways: First, it is a way to discover knowledge about how the educational growth and development of pupils can be improved; second, the analysis of interaction is a method of educating and training inexperienced teachers in pre-service professional programs and experienced teachers who must adapt new knowledge about teaching to their classrooms, their pupils, and their personal style of teaching.

With regard to creating knowledge, this Panel is proposing research on teaching designed to discover associations among the six classes of variables in Figure 1. With regard to teacher education and training additional classes of variables are helpful. In Figure 2,

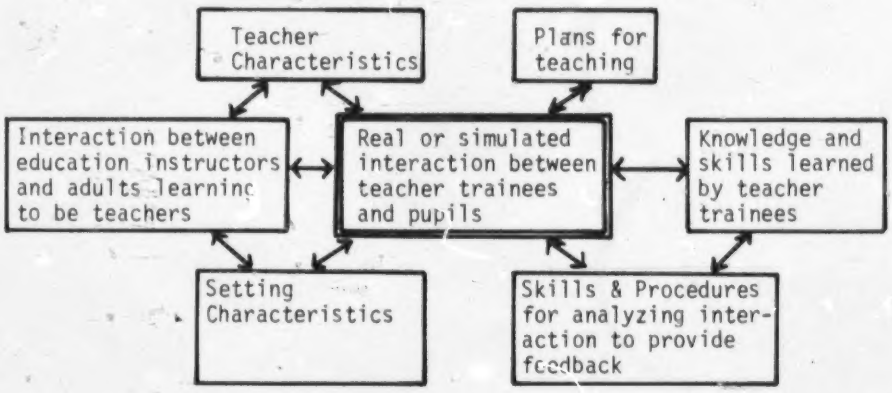

Teacher Characteristics
Plans for teaching
Interaction between education instructors and adults learning to be teachers
Real or simulated interaction between teacher trainees and pupils
Knowledge and skills learned by teacher trainees
Setting Characteristics
Skills & Procedures for analyzing interaction to provide feedback

Figure 2. Classes of Teacher Education Variables.

classes of variables for research on teacher education are shown. These classes overlap in interesting ways with those shown in Figure 1. For example, the central box of both diagrams represents a teacher interacting with pupils. But the product, in Figure 2, is the learning of the adult teacher. An additional box is shown for the interaction between the instructor (one who teaches teachers) and the adults who are learning about teaching. The Panel recognizes that education instructors, whether they are professors or supervisors, may be less than enthusiastic about being conceptualized as a class of variables in research on teacher education and may even resist efforts to analyze their interaction as they teach education courses. Nevertheless, their interaction with their students and the interaction of these adult students with pupils are both shown in Figure 2 because both classes of variables may be associated with the extent to which adults learn to become effective teachers. The major point is that the Panel is concerned with research that produces knowledge about teaching, on the one hand, and with how this knowledge can best be utilized by teachers, on the other hand. This dual concern leads to the discussion of validity in educational research which now follows.

The Panel's discussion began with the observation that we have made considerable progress in research on teaching during the past few decades. This progress has included the invention and refinement of procedures for analyzing human interaction. But too much of the research is irrelevant to pressing problems, such as the evaluation

of teacher effectiveness, and most research fails to be implemented in preservice and inservice teacher education. Nuthall suggested, in a pre-conference paper sent to the Panel, that researchers in this area have adopted procedures of research from the physical and social sciences which may not be appropriate to the study of teaching and that we may witness, during the next few decades, the development of new procedures specifically fashioned for research on teaching. One discussion on the topic of valid research seems worthy of special emphasis at this point.

Assumption One: Practically all knowledge about teaching that can be used by teachers will never be valid for all situations in which it might be used. A "p" value which might be assigned to each generalization is always less than 1.00. This value represents the proportion of situations in which one might expect the generalization to be valid. This state of affairs exists, in part, because we have not investigated and specified all of the possible conditional limitations to a particular generalization. If this kind of investigation and specification can never be accomplished, a "p" value of less than one is inescapable. By way of contrast, these "p" values for many generalizations in the physical sciences are so close to 1.00 that the discrepancy is inconsequential.

Assumption Two: Given "p" values that are less than 1.00 for practically all knowledge statements about teaching, anyone who uses this knowledge, especially a teacher, must not only decide when a generalization is relevant, but he must also be prepared to adapt and modify the generalization and try, as best he can, to make it fit the exigencies of the moment.

Given these two assumptions, the researchers who produce knowledge can choose to include the decisions teachers make and their efforts to adapt knowledge as part of the concept of validity. What this means is that the ultimate test of validity for any generalization about teaching is to ascertain whether teachers can use the generalization, how they use it, and what happens when they use it. Generalizations may attain one kind of validity because they (a) are the product of a scientific inquiry that included accepted procedures of sampling and replication and (b) are based on relationships of demonstrable strength. Yet this kind of validation may be inadequate for improving education because there was no test of how the knowledge can be utilized by practitioners. The issues involved in this problem are what this Panel calls the validity issue.

It would be naive to believe that the validity issue can be resolved by merely extending the concept of validity to include how knowledge about teaching is used by teachers. Indeed, the results of research on teaching as human interaction are likely to have implications for curriculum developers, architects who design instructional

space, educators who select textbooks, those who hire teachers, and any other educators who make decisions that affect instruction. The point to be emphasized is that some kind of test must be applied to the knowledge that is produced by research on teaching; one such test is whether a teacher can use it.

It would probably be disastrous to insist that every research project on teaching be required to investigate how the findings can be used by teachers and other educators. But if concern about extended validity is not the responsibility of every researcher, then whose responsibility is it? The Panel believes that this responsibility must be a national concern; it lies at the heart of the NIE mission, and can be implemented most effectively at the program level by coordinating a series of projects which form a program. Thus we might define a program so that it includes not only the production of knowledge about teaching but also the investigation of the utility of this knowledge. A project, on the other hand, need not necessarily contain both of these objectives. If such an extended concept of validity is unacceptable at the program level, then it must be the concern of both NIE and project directors at the level of approaches to research on teaching.

In this Panel report, research on teacher education is viewed as a testing ground for knowledge about teaching. We believe that if teaching itself is to be improved, the only knowledge that is relevant is knowledge that becomes valid because teacher educators and the teachers themselves can make use of it. In other words, knowledge about teaching must lead to changes in educational practice and some of these changes must turn out to be improvements. It seems highly probable that most knowledge about teaching can be tested by conducting research on the effectiveness of preservice and inservice teacher education programs. To summarize, the validity of knowledge about teaching includes the degree to which it can be demonstrated that teachers and other educators can use this knowledge in the improvement of education. To do anything less invites failure in our efforts to improve education.

Another view, expressed early in the work of the Panel, was that matters of research design and methodological flaws should be prominent in a review of research on interaction processes. One member of the Panel even expressed the opinion that selecting topics for future research was far less important than setting higher standards of research methodology. The Panel was uneasy with the conference plan of assigning methodological problems of research on teaching to a separate panel. As a result, we chose to include in our report a section on the methodological problems of research on interaction processes.

It was in this fashion that the report of Panel 2 gradually came to regard its total plan as having three major components: First, identify the kinds of knowledge that research on interaction processes can produce; second, show how the utility of this knowledge can be tested by research on teacher education; and third, make recommendations about research methodology as a guide for those who investigate interaction processes.

A POLICY OF SUSTAINED SUPPORT FOR RESEARCH ON TEACHING

The present section is a statement about the policy of supporting continuing research programs and the need for a sustained attack on some of our more difficult research problems.

A policy of supporting sustained programs of research on teaching so that cumulative results are obtained is vital not only for the accomplishment of the mission of NIE but also for the eventual solution of many basic problems in American education. Such a policy has too infrequently prevailed in past efforts of federal agencies to support educational research, and it is not a strong feature of the NIE program today. We should like to argue for a gradual shift to such a policy.

The Need for Research on Teaching

Classroom teaching is one of the most prevalent forms of social behavior in America. With the exception of our families, we spend more time in classrooms during our lives than in any other social context. Futures are built in the classroom: some lives are enriched and enhanced; others are stunted and warped. Moreover, the conduct of teaching is of transcendent interest to citizens. It is a focus of political activity and an arena in which an enormous industry is focused. And yet, only a handful of studies have yet been completed in which the activities of teaching were studied. It has often been noted that few dollars are set aside for educational research (compared with those available in other institutions). And, of these relatively few dollars, only a minute portion has been devoted to the study of classroom teaching. It seems to us that many of the problems besetting education today can be solved only when we have information concerning the activities of teaching -- which means that we must radically increase the number of studies in which teaching behavior and its consequences are examined. We should not want to denigrate other realms of educational research, but it seems to us vital that funds be sharply increased for studies of teaching if we are to solve such problems as the selection and education of teachers for effective performance of their jobs, the examination of the effects of innovations in educational practice, the development of teaching to suit the needs of pupils from special backgrounds, or the maximizing of effectiveness in relation to cost in education.

The Need for Programmatic Support

For many reasons, a substantial proportion of the funds set aside to support research on teaching must be given to research programs

rather than to projects. Short-term grant support may be appropriate in the physical sciences or engineering, where concepts and methods are more firmly established, where research depends to a larger degree on equipment (rather than people), and where knowledge concerning the effects of contextual variables has been backlogged for years. It is less appropriate in the social sciences, where research traditions are younger. It is particularly inappropriate in the field of teaching research, where data are costly and complex and where we are just beginning to explore the effects of contexts on teaching phenomena. Restricting support through a policy of "program purchase" is itself not the issue; it depends instead on the guaranteed duration of the program that is purchased. Research on teaching is more likely to make significant advances when efforts of an investigative team are supported for five years or more. Such support allows time to develop new concepts, instruments, and innovative designs for research. It allows time for the collection of laboratory and field data involving variations in context, for conducting a series of related experiments, and for developing curricular materials or teaching-training programs that are related to the findings of research. It allows the cumulation of equipment and the building of data banks, and for the assembly and encouragement of the talented staff essential to the labor-intensive conduct of research on teaching.

To make our point, let us consider briefly the time-honored method of supporting educational research through short-term grants. Such grants are awarded upon submission of a proposal by the researcher, either on his own initiative or through calls for proposals from the support agency. Grants are normally awarded through competition which places considerable emphasis on the ability of the investigator to write proposals but lays little upon his willingness to complete the research. It also encourages investigators to claim, and the agency to demand, that the proposed research "solves" problems within the compass of the research. (To say the least, many such claims are exaggerated, and both the agency and the research community get a black eye when they cannot be fulfilled.) More crucially, such a pattern of support prevents the investigator from assembling a secure team of researchers who will pursue a given topic over time, thus making less likely both basic research contributions and the wide range of practical spin-off that such a program can generate.

Instead of project support, we should like to argue that at least some funds should be set aside for long-term programmatic support of teams of scholars who will, in turn, make commitments to conduct research on a topic mutually agreed upon. Such support should only be contemplated for investigators of established reputation, should be given only after extensive negotiations between the agency and the researchers, and should be monitored by the agency on a regular basis to assure continuity and accomplishments within the program of research. Not all such programs need be conceived in massive terms; indeed some might consist of only one or two scholars who are working intensively on a smaller problem, or several scholars working in separate geographical areas but on a coordinated effort. Nor need all such programs be

conceived to set immutable five-year plans. Indeed, one of the best features of programmatic support (properly monitored) is that it allows the investigators to modify goals or research procedures so as to use the insights generated by findings or the opportunities provided by new techniques or equipment. But continuity of support should be provided by the agency, in return for commitments on the part of the investigators to undertake programmatic research on an agreed-upon topic.

Three Forms of Support

Not all research on teaching need be conceived in terms of programmatic support. Indeed, we conceive at least three different forms of support, each having its own features. First, funds should be set aside for small grants for research on teaching. Such grants should be seen as designed to attract young scholars into research in this field. They should be given for short-term support of dissertation research or other projects that can be completed within a year and should be awarded following submission of a proposal describing the proposed research. Second, other funds should be provided for project grants that are awarded on a competitive basis to more experienced researchers. Once again, these would be granted following submission of proposals, but the agency might take an active lead in calling for proposals on specific topics in research on teaching. Third, a substantial portion of funds available should be committed to a long-term programmatic support of established teams of scholars. Such programs would be established following careful negotiation between the agency and the investigators, would be focused upon agreed-upon topics of basic interest in teaching, would involve commitments from both the investigators and the agency, and would be monitored for accomplishments on a regular basis. For such programs, it should be emphasized, support would be provided not for the preparation and submission of proposals but rather for the completion of agreed-upon research.

Funds for Research on Teaching

Whether or not one agrees with the need for programmatic research, if we are to conduct research on teaching at any serious level, a radical increase in funds available for this purpose must be provided. The difficulty with good research on teaching is that it is much more expensive to conduct than most types of educational research. Such research often requires recordings of classroom lessons that cost upwards of $100 per lesson to acquire and process. These are much more expensive data than are pupil achievement scores, for example, or measurements obtained from teacher personality inventories. (They are also far cheaper than data obtained from a neutron accelerator, but then we are used to spending large sums for research in the physical sciences.) Because of this expense, studies of teaching to date tend to have been based on very small numbers of teachers, lessons, and variables. As a result, their findings are based on inadequate data.

The next generation of studies of teaching will require larger samples, more contextual variation, and the use of complex, multiple instrumentation for measuring the observed processes of teaching. These, in turn, will require substantial increases in the dollars needed for research in this vital field.

The need for increased funding is great, but so is that for the extended support of long-range research programs. We can see few alternatives to these proposals if serious progress is to be made in our understanding of the determinants, processes, and effects of teaching, and to the solution of pressing problems for which this understanding is vital.

APPROACH 2.1

DEVELOP KNOWLEDGE AND UNDERSTANDING OF HUMAN INTERACTION WITHIN EDUCATIONAL SETTINGS

The goal of this approach is to create knowledge and understanding of the processes of teacher-pupil and pupil-pupil interaction during teaching and learning. This interaction includes the ways in which teachers and pupils perceive, adapt to, and affect each other's activities. The Panel is optimistic that a new generation of variables based on interaction processes is within reach of our current technology, but only if research projects are organized and coordinated in such a way that more powerful research programs are created. This optimism in part reflects the first-hand experience of the Panel members, each of whom has contributed to present knowledge and research technology.

Many times during the Panel's deliberations, strong recommendations were made with respect to improving our national research effort. These recommendations include the following.

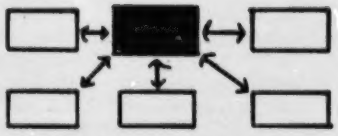
A. Long-term research programs which consistently attack research topics through field studies, laboratory experiments, and field experiments are essential. Short-term, single, uncoordinated projects should not be supported.

B. Data for research on teaching are very expensive, and ways to share these data through the development of data banks should be explored.

C. Ways to permit the analysis of the same interactive behavior by different analytical techniques are essential to the gradual development of new concepts and theories.

D. Most findings of research on teaching will be neither context-free nor linear. They are likely to depend on a host of interactions with context variables. Research designs that measure and control for context, presage, process, and product variables are essential to a more complete explanation of interaction processes.

Program 2.1.1: Develop New Ways to Conceptualize and Analyze Patterns of Teacher-Pupil Interaction.



From Figure 1.

The goal of this program of research is to increase our knowledge of interaction processes which occur as a result of teaching and learning activities. Concepts and instruments presently available for research on teacher-pupil interaction cover but a part of the field. Additional work is needed to cover aspects of teaching heretofore not studied.

What we mean by "new" requires some clarification. There is no need to fund projects which have as their main purpose the development of another category system. New knowledge would result if progress could be made in the analysis of longer chains of events, in separating events according to instructional purposes, in conceptualizing curriculum-specific interaction patterns, and in making comparisons of the explanatory power of different encoding/decoding systems.

Project 2.1.1.1: Design and Create the Capability of Establishing a Data Bank of Recorded Interactive Behavior Complete With Associated Paper-and-Pencil Test Data. This project is designed to overcome our inability to compare different systems of analyzing interaction processes. We recognize that there are limitations to a data bank and to the use of recorded interaction, but recorded behavior can be replayed so that cycles and then recycles of analysis can be carried out. If we are to achieve "new" ways to analyze interactive behavior, progress may be the result of trying out new concepts which lead to new, tentative theories, which in turn lead to new concepts, and these, in turn, lead to reformulated theory, and so on.

Ultimately, data may be sought in two locations, depending on the purpose. Data collected in a field study could follow a design which would ensure that the interaction was representative of current educational practice. Data collected in a laboratory classroom could be planned to represent interaction according to selected models and teaching strategies which were not necessarily representative of current practice. Projects of this kind should be limited to the purpose of developing new methods of analyzing interaction; the purpose is not to obtain interaction specimens for all grade levels, all subject matter areas, all types of teachers, etc.

Project 2.1.1.2: Examine the Cycles of Development Through Which Interaction Patterns Mature. There is a special need for projects which are concerned with the natural history of interaction patterns in classroom groups. We know too little about how patterns of interaction change with the passage of time and with the influence of group experience. We need better concepts and theory to discover the best interaction units (single event, pattern, chain) for explaining the influence of the teacher and then studying how this influence varies across one year and then several years. Progress in this area would help us understand the sequential character of teaching and learning. It would also help us to identify the missing intervening variables which are so conspicuously absent from most process-product research. It is not enough to know that teacher praise is correlated with positive pupil attitudes. We need also to know how praise affects interaction processes and how these processes, in turn, are likely to affect pupil learning.

Project 2.1.1.3: Develop Knowledge and Understanding of the Ways in Which Teacher Behaviors Influence Pupils and Pupil Behaviors Influence Teachers. Historically, research in this area has started with the assumption that teachers influence pupils, and in only a few instances have researchers investigated how pupils influence teachers. This project, like Program 2.1.2, has as its major objective an understanding of the immediate consequences of behavior; but in addition to the naturalistic studies of Program 2.1.2, research in this area lends itself to interventions by a researcher who chooses to instruct teachers or to instruct pupils with regard to their behavior. Projects within this program would be concerned with identifying:

(a) how teachers perceive and conceptualize pupil behaviors,
(b) how teachers' perceptions of pupil behaviors influence their choice or use of different strategies or tactics, and
(c) how teachers' perceptions of pupil behaviors influence their expectations concerning pupil ability, attitude, and performance.

To illustrate how a sequence of projects can make use of field studies, field experiments, and laboratory experiments, the following examples of investigations of how teachers perceive and conceptualize pupil behaviors might be planned:

Projects Type A: How do teachers perceive and conceptualize behaviors?

2.1.1.3.1: Naturalistic study of teachers' perceptions of the success and failure of their own interactive behavior.

2.1.1.3.2: Experimental study of teachers' perceptions of artificially induced pupil behaviors.

Projects Type B: How do teachers' perceptions of pupil behaviors influence their choice of different strategies or tactics?

2.1.1.3.3: Naturalistic study of the signs teachers use in determining what strategy to use and when to change a strategy.

2.1.1.3.4: Naturalistic study of the signs teachers use to select appropriate control and desist tactics in classroom interaction.

2.1.1.3.5: Experimental validation of the processes by which a teacher selects instructional strategies by creating artificially induced pupil reactions to the instructional strategies the teacher chooses to use.

Projects Type C: How do the teachers' perceptions of pupil behaviors influence their expectations concerning pupil ability, attitude, and performance?

2.1.1.3.6: Naturalistic study of relationships between pupil characteristics and teachers' expectations of pupils' ability to answer discussion questions.

2.1.1.3.7: Experimental validation of expected effects of pupil behavior on the development of teacher predictions about expected pupil question-answering behavior.

2.1.1.3.8: Development of a theoretical explanation of the development of teacher expectations drawn from relevant empirical evidence of earlier projects and appropriate psychological research on beliefs and perceptions.

Project 2.1.1.4: Examine the Different Interaction Processes Associated With Various Models of Teaching and Strategies of Instruction. The purpose of this project would be to collect the interaction data necessary to distinguish among different teaching models or instructional strategies. In this project, the procedures could be quite similar. First, a sample of teachers would be trained to teach according to an accepted model or instructional strategy by procedures that are described so completely that they can be replicated. Second, the teachers would teach their classes according to this strategy or model. Third, consistent interaction data during the instruction and appropriate data concerning pupil learning outcomes would be collected. Fourth, the data would be tabulated and made available to educators who were interested in making comparisons among different teaching models and instructional strategies.

In this project, a teaching model or instructional strategy refers to a well recognized method of teaching. The book by Joyce and Weil (1973) on teaching models, the book by Morine and Morine

(1973) on instructional strategies based on discovery teaching, and recent writings on "open classrooms" provide examples of such models. During the next decade it is likely that additional works advocating such models of teaching will become available. Yet very little is known about the interaction processes that are likely to result when a teacher attempts to teach according to some model. Often the claims made by those who advocate the use of one or another model rest on little or no empirical evidence. In spite of the lack of evidence, scarce resources are expended in conjunction with inservice and preservice teacher education programs.

Program 2.1.2: Examine Relationships Among Interaction Processes, Context and Setting Variables, and Pupil Characteristics.

From Figure 1.

Interaction processes will differ depending on school climate, curriculum, classroom equipment, and the composition and size of the pupil population. In general, we know far too little concerning the range and variability of teaching-learning phenomena across contexts; and we do not know which contextual variables will make large or small differences in the conduct of teaching. Can we expect interaction to be substantially different, for example, in poor and rich schools? Does interaction differ when pupils are bused to a different school than the one in their own neighborhood? What are the effects on interaction of language differences between pupils, teachers, and instructional materials? With respect to most of these questions, there is too little authenticated knowledge and far too much speculation that is passed off as valid information.

When this Panel conducted a survey of its "constituent community" of research workers, the suggestions dealing with the educational problems of racial minorities had about the highest frequency. What kind of justice would combine a compulsory attendance law with interaction processes which not only ignore one's native language but may be demeaning with respect to the culture of most pupils? How do interaction processes sustain sex stereotypes?

Another perspective on context can arise out of the purposes of instruction and the natural sequence of stages of learning. One might expect that when the purpose was to motivate pupil interests, a teacher would try to create interaction processes that are quite different from the processes created when students are engaged in sharing experiences or in summarizing learning just completed. Yet in many projects which involve some form of interaction analysis, single events are tabulated from long periods of observation and then interpreted as if all the data came from a homogeneous context. There is

little likelihood that we can teach preservice and inservice teachers useful knowledge about interaction until we can at least associate different patterns with their appropriate instructional purposes.

Project 2.1.2.1: Determine the Effects on Interaction Processes of Differences in Educational Settings. Projects in this area are likely to be given high priority since some of the early studies (U.S. Commission on Civil Rights, Mexican American study, 1973; reported on also in Jackson and Cosca, 1974) suggest that the civil rights of young people are being compromised due, in part, to our lack of knowledge and to our inability to apply what knowledge we do have. The problems in this area illustrate with unusual sharpness why knowledge of interaction processes must be tested in terms of its utility for teachers. The most urgent need is for information which teachers can use constructively. With regard to racial, ethnic, religious, SES, and sex differences, our most urgent need is to distinguish between problems which can be influenced by the different tactics available to the teacher and those problems that cannot be so influenced. The same observation applies to administrative actions, curriculum changes, and community options.

What we are proposing here is that education for a minority child is likely to improve to the extent that he interacts differently with the teachers, his fellow pupils, and the instructional materials. The establishment of baseline data so that interaction variables can be associated with pupil characteristics and with variables based on different educational settings would appear to be an urgent first step. From a thoughtful analysis of such data should come some hypotheses about how the quality of education can be improved. These hypotheses, in turn, would be tested within a teacher education program whenever some modification in teacher behavior was expected.

Panel 2 is well aware that other panels, especially Panel 5, will have additional recommendations concerning language and cultural differences. We add our comments to lend emphasis to work of the other panels.

In addition to the kinds of variables mentioned in the foregoing paragraph, other conditions could be studied in the same projects. Community variables needing study include size, ethnic composition, affluence, occupational distribution, and physical features. School variables include size, crowding, school climate, staff organization, composition of the student body, and such features of the school as a whole as pressures to participate in extra-curricular activities and the status structure of the pupil population. It is often stated that variables such as these either constrain or stimulate the processes of interaction. It is time we found out whether these statements are true.

Project 2.1.2.2: Determine the Effects of Classroom Contexts on the Processes of Interaction. Studies falling into this project will concern themselves with variables such as the physical features of the classroom: size, degree of crowding, lighting, carpeting, and the presence and use of educational media such as television or teaching machines. Again, the influence of such factors on interaction is often argued but seldom studied. Some studies in this project will be concerned with the assessment of new innovations in education, such as studies of the influence of laboratory equipment and language laboratories. Studies of interaction in open-plan schools also fall here and are of vital importance to the current educational scene in America.

Project 2.1.2.3: Determine Associations Between Interaction Processes and the Immediate Purposes of Instruction. Investigations on this topic are concerned with the natural cycles of learning and instruction which create a context for interaction, pupil perceptions, and teacher perceptions. One way to conceptualize these cycles is in terms of shifting instructional purposes. In the average teacher-dominated classroom, these cycles might include getting ready for work, going over work recently completed by pupils, introducing a new assignment, helping pupils get started on the new assignment, supervising work on the assignment, and cleaning up materials at the end of the work period. With different purposes and class formations, one would expect different interaction patterns.

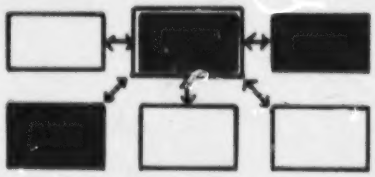
It is clear that projects of this kind can take place in the field or in a classroom laboratory, with natural behavior or with planned and practiced behavior; each configuration of conditions would provide additional knowledge. A direct consequence of projects of this kind would be knowledge of how interactive events can be arranged into more homogeneous clusters. This knowledge, in turn, when used in process-product research, would provide us with predictor variables based on interaction that would probably form more powerful relationships with pupil learning variables.

Project 2.1.2.4: Determine the Effects of Variables Concerned With the Curriculum and With the Composition of the Pupil Population on the Processes of Interaction. Studies in this project will be concerned with class size, grade level, ethnic composition, ability level, social class background, and other variables associated with pupils in the classroom. Such studies may consider pupil information from at least two perspectives. On the one hand, some aspects of interaction may turn out to depend wholistically on the composition of the pupil group. Teachers may respond differently, for example, to a class that is composed entirely of girls, entirely of boys, or one that is sexually mixed. On the other hand, additional aspects of interaction may turn out to reflect the identity of the specific pupil. Teachers may treat boys differently from girls in the same classroom, for example,

or may discriminate in their behavior between the treatment given to black and white pupils. Interaction may also be different, depending on pupil identity (teachers may be more tolerant of poor answers from some pupils than from others, or pupils representing minority groups may be treated differently by other pupils). Questions of these sorts are of vital importance to citizens, as well as to educators, and some studies concerned with the impact of pupil characteristics on the processes of teaching have already been completed. We need more studies such as these.

It is quite clear that the above associations should be investigated separately for different age levels, different subject matter areas in junior and senior high school, and for face-to-face groups of different size. We have relatively little information, for example, on the percent of total talk which individual pupils provide, aside from the Stephan-Mischler curves (1955).

Program 2.1.3: Develop Knowledge and Understanding of the Relationships Among Teacher Characteristics, Teacher-Made Plans for Instruction, Interaction Processes, and Pupil Perceptions of These Processes.



From Figure 1.

The goal of this program is to determine the ways in which the beliefs, attitudes, experiences, physical appearance, and other attributes of teachers affect the patterns of interaction. These relationships will be investigated with attention to the teacher's "preactive" plans for instruction and the pupils' perceptions of the teacher and his instruction. A major outcome of work in this area would be to vary teacher education learning experiences in terms of teacher aptitudes and other characteristics.

Project 2.1.3.1: Develop Knowledge of the Ways in Which Specific Teacher Purposes and Beliefs About Teaching Result in Identifiable Patterns of Interaction.

Projects within this program would be concerned with how the teacher's beliefs and purposes result in identifiable patterns of interaction and with how these beliefs and purposes are modified by actual events in the classroom. What we need to discover is how teacher purposes or plans operate, how teachers can maintain different kinds of purposes at the same time, and how such purposes are changed or discarded in response to interaction experience. Little is known concerning the effects of teacher beliefs today, and yet teacher education programs are predicated on the assumption that such beliefs will determine the teacher's classroom behavior. Information concerning this assumption is vital for planning effective teacher education.

Project 2.1.3.2: Develop Knowledge and Understanding of the Ways in Which Teacher Beliefs and Feelings About Pupils Influence Interaction Patterns.

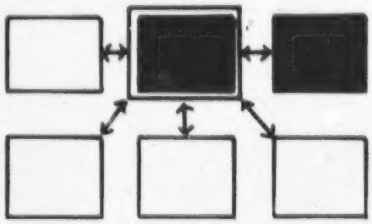
This project would be concerned with how teachers' beliefs about children of different ages, classes, ethnic backgrounds, etc., influence the way in which they interact with these children. Special attention needs to be paid to the ability of a teacher to identify differences among individual pupils, and to the ability of a teacher to accommodate identified pupil differences. Information from such projects is of concern to citizens concerned with equality of treatment in education and to educators who seek to build in teachers the ability to provide individualized instruction.

Project 2.1.3.3: Develop Knowledge and Understanding of Relationships Between General Teacher Characteristics and the Patterns of Interaction Which Occur in the Classroom.

Since there has been a considerable amount of unsuccessful research in this area, the difficulties of funding research that will be successful should not be underestimated. Probably most of the teacher personality tests have proven to be of very limited value. The Minnesota Teacher Attitude Inventory, the Rokeach Dogmatism Scale, and perhaps the ETS National Teacher Examination may have the best performance records within a class of poorly performing variables.

Our Panel is disposed to recommend funding research in this area only when more situation-specific teacher perceptions and attitudes are being measured. Another alternative is to explore teacher characteristics scores which are actually interaction variables gathered under standardized, but simulated, conditions. Our opinions here are speculations, at best, and the priority for this kind of research would undoubtedly be low.

Program 2.1.4: Develop Knowledge and Understanding of the Relationships Between Teacher-Pupil Interaction and the Effects of the Interaction on Pupils.



From Figure 1.

Of all knowledge about teaching, knowledge of the effects of a teacher's interaction with a pupil on the development of that pupil is of greatest interest to educators and citizens.

Unfortunately, research in this area has suffered from a strange twist of fate. In the late 50s and the decade of the 60s there were

no well accepted procedures for quantifying aspects of interaction. Thus, during this period much energy was spent on developing systems of interaction analysis, and the progress was quite remarkable. In the meantime, little or no thought was given to the tests that would measure learning outcomes because it was falsely believed that all the necessary tests were available. It soon became apparent that nationally standardized tests were to a degree measures of academic aptitude, as well as sometimes measuring achievement of objectives toward which the teacher did not teach. Probably the latter problem is more severe at higher grade levels. In any case, the notion that there ought to be simple correlations between an interaction variable such as praise and a measure of adjusted academic achievement settled slowly in the quicksand of low, positive coefficients. The correlations are so low that they would be significant only if there were more than 30 teachers in the sample.

There is no doubt that research associating a single interaction variable with achievement should never be expected to produce a high correlation. Two kinds of improvement can be expected during the next ten years. They are described in the first two project descriptions which now follow.

Project 2.1.4.1: Design, Develop, and Evaluate Measures of Learning Outcomes for Use in Process-Product Research. There are really a series of important projects which should be given the highest possible priority in research on teaching. The first of these is to design, construct, and evaluate "evaluative teaching units," or ETUs. An ETU consists of all the instructional materials for a full-size class, covers a wide range of reading ability, provides a pretest and posttest of achievement and attitude, and so on. It can be used when a measure of subject matter learning is required. It has the advantage that a pupil's gain score on the test of achievement is more likely to be influenced by what goes on in the classroom.

Besides the development of ETUs, there is a need to explore a wide variety of measuring instruments. Measures of positive attitudes toward the teacher and toward learning activities, schemes for observing persistence or lack of distraction, ways to measure the pupil's level of aspiration with regard to learning, even days of absence and dropping out, and ways to measure a pupil's self-concept with regard to success with the subject matter are all worthy of trial development. It is quite possible that measures not directly related to subject matter achievement may provide a more successful measure of effective teacher-pupil interaction because such scores are less contaminated by the basic academic ability of the pupil. It should be recognized, however, that even with good progress in the development of measures of learning outcomes, we will still fall short in developing good explanations of teaching and of the effects of different patterns of interaction if we do not have meaningful intervening variables.

A second requirement, then, is the development of good intervening variables which are likely to be based on the immediate reactions of pupils to particular patterns of interaction. Projects 2.1.1.1, 2.1.1.2, 2.1.1.3, and 2.1.1.4 should be combined with multiple measures of pupil outcomes in order to isolate the intermediate steps of functional relationships. The Panel considered these more immediate responses of pupils so important that the topic is discussed in the next section in addition to those sections just cited.

Project 2.1.4.2: Determine the Immediate Effects of Teaching on the Reactions of Pupils. A second need is to establish the immediate effects, on pupils, of exposure to various experiences of teaching. Such information is needed by teachers who want to improve their classroom performances. It is also vital to building empirically-validated theories of teaching. A number of techniques may be recommended for this purpose, including those involving stimulated recall and intensive interviewing of pupils for salient experiences in teaching. Another technique would be to construct criterion tests immediately after the lesson -- tests that will reflect actual (rather than planned) lesson content. Still another is to conduct experimental research in which criterion tests are keyed to variations in curricular treatment. Techniques such as these lend themselves, particularly, to studies of the differential treatment of individual pupils, as well as to studies of the responses of individual pupils to the common lesson.

Project 2.1.4.3: Determine the Long-Term Effects of Teaching on the Reactions of Pupils. A third project concerns the long-term and cummulative effects of experiences of teaching on pupils. Most process-product research on teaching to date has paired only one or two observations of the teaching context with a long-term measurement of pupil response. Such studies are weak, for we are provided information on neither the longitudinal processes operative in the classroom nor the way in which these cumulate in the thinking of pupils. Good designs for this program would feature either or both of these types of measurements. Information provided in this program will have significance for our understanding of the cumulative effects of classroom experiences and will enable school personnel to plan curricula that will provide maximal learning experiences for pupils. At least some studies of this project should concern themselves not only with cumulation within a given classroom over the school year or semester, but also with cumulation of educative experiences over several lessons that are experienced by the pupil serially. Other studies should concern the effects of short-term sequences of classroom events, such as strategies followed by the teacher in presenting subject matter, in managing the classroom, and in using praise or punishment.

It will also be important to examine the question of whether the same strategies or patterns of interaction which are associated with increased gain in the short run are also associated with increased gain in the long run -- the school year, the summer following the school year, or more extended periods.

Project 2.1.4.4: Validate the Results of Previously Reported Empirical Studies of Process-Product Relationships. Reviews of process-product studies in the literature have identified a number of variables which seem to be related to pupil achievement gains. The purpose of this project will be:

(a) to develop low-inference instruments to measure these variables and

(b) to study the relationships of these measures not only to achievement but to other outcome measures.

2.1.4.4.1: Study the correlations between low-inference and high-inference variables designed to establish the behavior base of the latter.

2.1.4.4.2: Relate the low inference process variables to multiple outcome measures.

2.1.4.4.3: Obtain information about
(a) whether the pattern of teaching behavior differs for different outcome measures, and
(b) what these patterns are.

2.1.4.4.4: Study the generalizability of the findings in 2.1.4.4 across different curricula, pupil populations, etc.

2.1.4.4.5: Develop teacher training procedures based on above findings and culminate in a series of field experiments designed to establish cause-and-effect relationships.

Project 2.1.4.5: Provide Empirical Validation for Widely Held or Well-Supported Assumptions or Theories About the Effects of Particular Patterns of Classroom Interaction. There exists in the educational community a significant number of assumptions and beliefs about how different kinds of teacher behaviors affect the development of pupils. From time to time these beliefs are added to by educational theorists and innovators who propose new propositions about teacher effectiveness. To protect the educational community from the danger of building hopes and programs on the basis of unsupported beliefs, there is a need for projects designed to test the validity of these beliefs or theories.

Each project would need to:

Operationally define the model in terms of interaction patterns (develop an instrument for systematic observation)

Train teachers to exhibit the specified interaction pattern(s)

Validate the pattern in terms of predicted pupil outcome measures.

Determine the relationship between predicted pupil outcomes and other outcome measures

Compare the "model" interaction with other "model" interactions in terms of their relationships to patterns of outcome measures

Project 2.1.4.6: Determine the Relationship of Classroom Interaction to Individual Pupil Gains. (This project was not further developed.)

Project 2.1.4.7: Identify Unique Interaction Patterns Associated With Different Types of Outcomes. The data base for this project would be a set of videotape recordings of all the interaction during the teaching of the same brief unit by a sample of secondary school teachers, plus profiles of pupil gains on a set of measures of different outcomes and data on appropriate context variables.

A number of different interaction analysis instruments would be used to derive behavior profiles on the taped behaviors, and a number of analyses of these data would be carried out.

The principal analysis would be based on the assumption that there are important qualitative differences in teacher effectiveness and would seek

(1) to identify behavior patterns associated with them,

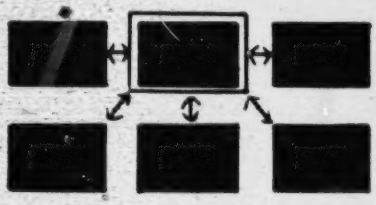
(2) to establish cause-and-effect relationships among them, and

(3) to develop training materials from the videotapes.

By inspection of the outcome profiles of the teacher, small groups of teachers whose outcomes differ qualitatively from one another (but are homogeneous within groups) will be identified; then a multiple descriminant analysis of the behavior measures will be made to identify behavior patterns unique to each type of outcome.

Samples of students in preservice teacher education programs will be trained to produce two or more of the patterns and experiments will be conducted to determine whether a change in the pattern of instruction a teacher uses will result in the expected change in pattern of outcomes.

Program 2.1.5: Determine the Complex and Contingent Relationships among the Determinants, Processes, and Effects of Teaching Through Studies Involving Three or More Variable Classes.



From Figure 1.

Most relationships among the determinants, processes, and effects of teaching depend on the school and classroom context and the characteristics of pupils. This dependency means, for example, that the effects of a given interaction processes can always be modified by various context conditions. There are several ways to control complex and contingent relationships. One approach is to measure everything, an alternative being to randomize the effects of most variables but allow a few to vary systematically. There are, of course, positions between these two extremes. A second choice is that between the conduct of research under "natural" conditions and the manipulation of the more important independent variables. An example of the latter is to train teachers to create certain required interaction patterns as experimental "treatments".

Just because a study is a true experiment or a natural field study does not by itself increase or decrease its potential contribution to the improvement of education. Either kind of study can involve typical or atypical interaction processes. Either can be more or less lifelike or more or less representative. It is true that natural field tests are more likely to reflect the restraints of common practice, while true experiments are not restricted in this manner.

Project 2.1.5.1: Develop Empirically-Based, Explanatory Theories for Teaching That Accommodate the Findings of Prior Research. At present there is little secure support for review, synthesis, and development of theory concerning teaching as human interaction. Such theories are needed to provide educators with explanatory tools that will help generate applications of research. They are needed also to provide guidance for further research. Regular efforts at review, synthesis, and development of theory should be commissioned.

Theories are most likely to come from reviews which provide thoughtful syntheses of material.

Project 2.1.5.2: Examine Many Different Arrangements of Independent and Dependent Variables in a Multifaceted Study of Teaching as Human Interaction. There is no purpose to be served by attempting to enumerate the many different arrangements here. The points that have already been made about outcome measures (cf. 2.1.4) apply to this discussion. Since pupil ability is the single best predictor of academic achievement, the control of this variable in any research on teaching is mandatory. Other characteristics of pupils such as socioeconomic status, racial background, native language, self-concept, academic optimism, internality, and perceptions of teaching behavior, to name a few, may also influence interaction processes and thus should be investigated. Setting characteristics, which include characteristics of the school, classroom, and community, as well as the dynamic context of interactive behavior, may also be a class of variation which should be taken into account. Teacher characteristics, training, and tendency to use lesson plans are also factors which influence instruction.

Assuming that there will be fewer research dollars than there are ideas for spending them, the Panel considered the question of what kind of multifaceted research should be encouraged. Although each member of our Panel had his own bias in responding to this question, there were areas of agreement.

1. We believe that single research projects should not be funded and that long range, carefully designed programs which make full use of field and laboratory settings and of correlational and experimental methods, and which are directed by researchers who have previously established a record of success in research, will provide the most return for each dollar invested.

2. We believe that a number of researchers, agencies, and institutions are ready, qualified, and willing to engage in research programs involving the cooperative exchange of information, instruments, materials, and procedures as well as entailing coordinated sampling, replication, and data analysis. Our Panel is certain that it is an NIE responsibility to encourage this kind of research program.

3. We believe that a long-range, extensive research program includes translating the research conclusions into principles of instruction and finding out how teachers can best learn and then implement such principles. We are not speaking, here, about nationwide dissemination and utilization programs, but we are advocating at least a single demonstration project in an inservice or preservice setting.

APPROACH 2.2

DEVELOP KNOWLEDGE AND METHODS USEFUL IN THE UNDERSTANDING AND IMPROVEMENT OF TEACHER EDUCATION

Competent research on teacher education should

(a) help to produce more effective beginning teachers,

(b) help experienced teachers upgrade their teaching more effectively, and

(c) provide a setting in which we test the utility of knowledge about teaching.

Panel 2 was concerned with how the analysis of interaction enters into research on teacher education. Analyzing interaction has been a feature of some programs of teacher education for a long time as a topic to be taught, a skill to be learned, a procedure for encoding and decoding one's own behavior, and, in general, a way to focus attention on overt behavior. Unfortunately, these innovative trends probably apply to only a small proportion of persons who are exposed to some form of teacher education. For example, Johnson (1968) found that only 30 out of more than 850 teacher training institutions "used microteaching extensively," and only 17 reported the same high use of Flanders' interaction analysis. Since that survey, interest in analyzing interaction may have increased, but it must be safe to say that a majority of adults who participate in some form of teacher education are probably exposed to the same curriculum and teaching methods that existed more than 20 years ago. Aside from the problems of dissemination and innovation, our concern with teacher education can be expressed in five questions:

1. How do teachers think about interaction and make decisions concerning their own participation?

2. How can teachers improve their own interaction?

3. How can the information, if it is to be used as feedback to a teacher, be improved in terms of its nature, amount, and timing?

4. How can computer based systems be adapted to teacher education?

5. How can educators best respond to the demands or laws which affect the evaluation of teachers?

Improved human interaction in teacher education is considered to be a problem in adult learning. Learning about interaction is expected to transfer from training to classroom teaching so as to improve instruction. We have some general observations about conducting research when teacher education is conceptualized in this manner. Research on teacher education should meet the following criteria:

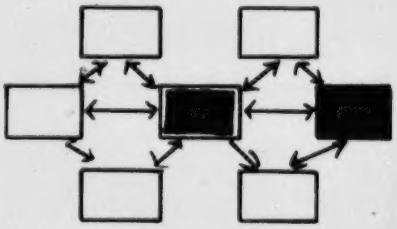
-- Specific teacher training objectives should be stipulated in behavioral terms.

-- Objectives should be measured in reliable and valid interactive contexts.

-- Specified training variables, procedures, materials, sequences, and so on, should be replicable.

-- The research should be designed to insure external validation of results by including effects on students.

Program 2.2.1: Investigate How Teachers Think About Interaction and Make Decisions About Their Own Participation.



From Figure 2.

By merely raising the question, "How do teachers think about interaction?" we express our ignorance eloquently. To raise questions about how teachers decide to participate, is to call for an examination of the assumptions on which teacher education rests. For example, do teachers need more skills? Or, do they need to make a better match between the skill chosen to be used and the exigent circumstances? Moreover, since thinking is influenced by learning, there should be an intimate relationship between how one thinks about interaction and the training he has had in analyzing interaction.

We have learned that when teachers analyze their own interaction they are likely to modify how they interact (Amidon and Hough, 1967; Flanders, 1970). Here we have another case of process-process relationship with no specified intervening variables. If it is true that teachers modify their interaction after they analyze it, why does this occur? Are teachers learning new skills because they need to increase their repertoire? Or do they need to discriminate more wisely with respect to the situation and the skills they already possess?

Project 2.2.1.1: Study the Relationships Between Training in the Discrimination of Interaction Patterns and the Cognitions Involved in Sensing and Perceiving These Discriminations. This kind of research would, of course, take a good deal of imagination, careful planning, and persistence in the face of early disappointments. It is not easy to obtain valid introspective information. The essentials of the design include collecting and studying the cognitions of a teacher with regard to interaction before, during, and after a program of training which consists of learning how to discriminate interaction patterns. Once some initial progress is made, the possibilities of employing different kinds of training or studying the teacher in different kinds of interactive situations are, if anything, too numerous.

With regard to research techniques for analyzing an individual's cognitions, there has been some progress. The "alter-ego" method is to train two teachers until the evidence suggests that they think very much alike (about each pupil, the lesson plan, etc.), then have one introspect constantly while watching the other interact with pupils. Another method is to allow a teacher to proceed up to a decision point: at that instant remove the teacher, let a substitute carry on, and interview the teacher with the assistance of video or audio playback to help recall the interaction just *before* the decision point. Various other introspective assessment techniques, such as Q-sort cards, can be employed.

This would be a low-cost, high-risk project that could be very rewarding. It might be pushed through its initial phase by supporting one, skillful researcher (contrary to the more complicated designs discussed on earlier pages.)

Project 2.2.1.2: Investigate the Ways in Which Teacher Trainees Act and React Within Different Interaction Patterns. The essence of this design is to use preplanned live and simulated interaction as the independent variable which creates "treatments" for adult teachers. Before teachers are exposed to these planned interaction patterns, they are trained to react in reasonable ways to particular interaction patterns. Teachers are then exposed to interaction patterns which they can recognize as falling within their training repertoires, to patterns which are similar but not quite the same, and to patterns which are unlike any that occurred during training. The primary purpose of the project is to classify the reactions of the adult trainee and try to find out what steps of decision making were carried out.

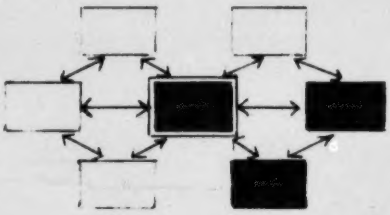
The purpose of this research is to gather the building blocks for a decision-making model. Another purpose is to locate descriptors which characterize a teacher's cognitions when transfer of a skill is successful and when it is not successful. These descriptors in turn might be related to valid and invalid discriminations among interaction phenomena, and/or with accurate and inaccurate judgments in matching the appropriate reaction to the perceived pattern.

This project is a natural outgrowth of 2.2.1.1, and could be conducted by the same single researcher (with the same high risk but possibly high payoff). It might lead logically to the project which now follows.

Project 2.2.1.3: Design and Evaluate Various Decision-Making Models Which Apply to Choices a Teacher Makes While Interacting With Pupils. Teachers have a purpose at any particular point in a chain of interaction. They should be able to judge the relevance of nearly any kind of pupil behavior by comparing it with their instructional purposes. From such judgments teachers are likely to support and reinforce some behaviors, reject or counter behaviors that are judged undesirable, and be neutral toward or just ignore the rest. We have no models of such decision making which are being seriously investigated by researchers. We are almost completely ignorant about these decision dynamics.

Perhaps the only way some kind of progress can be made in this essential area of interaction is for someone who is especially well qualified to be given a commission. An outstanding scholar might be given four to eight years of modest support to work on projects such as 2.2.1.1 to 2.2.1.3.

Program 2.2.2: Conduct Basic Research on the Capacity of an Adult to Receive Feedback Information While Interacting With Pupils.



From Figure 2.

Program 2.2.2 deals with the exciting topic of computer based systems for teacher education. Simultaneous with work on these more powerful computer based systems, we need research that will examine the capacity of an adult to receive, process, and act on information while actively engaged in learning interaction skills. The entire microteaching movement has gone too long without serious consideration of different aspects of feedback: frequency, timing, and the level of concentration on feedback that a motivated adult can tolerate. Microteaching introduced the cycle of teach-reteach-until-a-standard-is-reached, but the corrective feedback has usually consisted of video or audio playbacks of one's own teaching plus the help of a counselor -- if one is available. The assumption that a trainee can view or listen to a recording of his own interaction and obtain fresh insights from this experience needs to be reexamined. It is quite possible that the constructive effects of microteaching with video feedback can be doubled or even tripled if we could take full advantage of the adult's capacity to make use of feedback.

Project 2.2.2.1: Conduct Laboratory Experimentation on the Capacity of a Motivated Adult to Receive, Process, and Act on Different Kinds of Feedback Information While Learning How to Create Desired Patterns of Interaction. The application of interaction analysis to teacher education has already been shown to influence how trainees think about interaction (Morine, 1973). Like language, any form of interaction analysis is essentially an encoding-decoding procedure for dealing with ideas. What we have yet to discover is the range of information about interaction which can be communicated and the most efficient language for communication. From recent experiments (e.g., Semmel, 1972), it is clear that messages can be sent to a teacher-trainee almost continuously during a short micro-teach or a longer class lesson. If these messages use a language that does not interfere with ordinary verbal interaction, for example a visual-nonverbal-display-channel, it may be possible to send a wide range of messages. The messages might concern:

(a) a summary of interaction up to the moment;

(b) a comparison of completed interaction with a plan or model;

(c) a warning of a choice point that is about to occur;

(d) information about a child or event which the teacher was unable to see;

(e) instructions about what should be done next;

(f) a request that something that was unsuccessful be attempted once more;

and any number of additional messages or instructions which concern the past, present, or future.

In addition to the nature of the message itself, a second source of variation is the message sender or originator. It is clearly possible to employ electronic circuits to feed back the average perceptions of a group of pupils. Besides the pupils, an experienced observer-trainer may send the messages. In college preservice courses, it may be a fellow college student. In an inservice setting, it might be the building principal, a subject-matter supervisor, a fellow teacher, or a specially trained pupil. In one laboratory demonstration, a trainee even received his own previously recorded verbal statements as a form of feedback.

A third source of variation is the timing, frequency, and intensity of messages. These variations, in turn, need to be tried out when there is a relatively simple skill that is being learned and when a longer and a more complex teaching strategy is being learned.

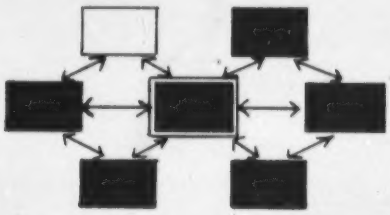
The expected product of this kind of research would be the design, evaluation, and implementation of training systems with which certain skills, strategies, and interaction patterns can be learned not only at a higher standard of performance, but in less time, and by more types of people. This optimistic claim is based, in part, on the more efficient procedures which now can be used to train interaction analysis observers to higher levels of reliability in less time.

Only the most radical and experimental teacher education programs currently make extensive use of microteaching and fewer still combine microteaching with interaction analysis. Even the most advanced of these programs are predicated on a cybernetic feedback model that may be badly flawed. Teachers are expected to modify their behavior in a desired direction during their next teaching practice session because, for example, they have studied their last teaching performance in a critical manner. It is not unfair to describe this procedure as one in which we study our past mistakes in order to avoid them in the future. This procedure can be very inefficient in that it may ignore the potential benefit of providing trainees with instantaneous information about the current moment, information about events or decisions likely to occur in the next few minutes, or a prediction of the probable consequences of a line of action before it even begins. This wider spectrum of information and flexibility of timing may be more powerful and efficient. It also may train teachers to become predictors rather than reactors, to anticipate what may happen and, if necessary, prevent it.

Project 2.2.2.2: Explore the Need for Autonomy While Learning Progressively More Complex Interaction Skills. A good deal of activity in the field of performance-based teacher education (PBTE) rests on programmed learning materials. Furthermore, performance comparisons are often made with a prescribed standard or with a model of interaction which "is given" to the trainee with the implication that he should make use of it. The use of programmed materials to reach a prescribed standard may however, make the trainee dependent and compliant. In other words, following directions and depending on "external structure" seems to be a by-product of using many of the materials which are recommended for PBTE. The notion that, in order to be successful, a teacher must learn the opposite, namely, to design his own personal inquiry, to carry it out, and to reach judgments about his own standards of performance, creates a contradiction or inconsistency between desired ends and the means of programmed learning.

This project proposes to investigate materials which assist a trainee to learn valuable interaction skills, but which simultaneously require the trainee to design and carry out, on his own, an increasing proportion of the training activities. In short, this project would attempt to design a general model of professional self-inquiry and then explore how it could be used in the learning of different interaction skills in both preservice and inservice settings. One variation to be explored is the development of peer relationships, especially "partnerships for inquiry," in which personal autonomy would be cultivated because superior-subordinate partnerships are avoided. It is obvious that the assumptions of this project need to be tested. We need to know whether a teacher who is exposed to more "autonomous" materials will become more self-directing and therefore a more successful teacher. Put another way, we need to know what effects such materials would have on a trainee and on his ability to guide interaction.

Program 2.2.3: Explore Systems Development for Teacher Education in Preservice and Inservice Programs.



From Figure 2.

One of the most powerful innovations in teacher education in the past five years has been the exploration and development of computer assisted teacher training systems, or CATTS as its foremost proponent (Semmel) chooses to call it. As more elaborate computer hardware and previously written software become less and less expensive, and as demonstration projects succeed in resolving the first generation problems, the clerical tedium of analyzing interaction can be eliminated, freeing trainee and trainer for the more human tasks of blending data, interpreting data, and playing back the original interaction. Learning how to control one's own behavior, during spontaneous interaction, may be enhanced by a thoughtful synthesis of objective data and subjective perspectives, but the latter cannot occur when the former require tedious clerical chores. Further, the shift toward training teachers to become both predictors as well as reactors, discussed in Project 2.2.2.1, is likely to become possible and more cost-efficient with computer assisted systems.

We should note for the record that, at least once, while this Panel was meeting at the Dulles Airport, a classroom observer in Cleveland telephoned a computer in Bloomington, Indiana, used the telephone push-buttons to encode interaction, pulled out the phone plug at the end of the observation, re-established the call at a telephone facsimile reproducer, and received a tabulated and graphical display of the interaction data less than 15 minutes after the observation stopped. We might also note that, before the Panel met, preliminary experiments in providing a teacher with "predictive" feedback, in a laboratory classroom, had already occurred.

Systems of this kind should have a capability for training teachers within their respective classes, should provide relatively rapid feedback to teachers based on interaction data, should require a minimum of teacher effort for the maintenance of the system, and should have demonstrable effects on changing teacher behaviors.

Research in this area should reach the following six objectives:

(1) The development of a feasible model for the delivery of rapid feedback to teachers relative to interactive behaviors in their classrooms or in simulation exercises.

(2) The development of a feasible computer-based system for the rapid collection, summarization, analysis, storage, and retrieval (i.e., feedback) of interaction data.

(3) The development of feasible procedures for constructing and modifying meaningful observation instruments matched to the needs of teachers working in a wide variety of contexts.

(4) The development of a feasible paradigm for training and maintaining the observation skills of observers within the context of both preservice and inservice teacher training programs.

(5) The development of feedback modes and displays with demonstrated clarity adequate for decoding by in-service teachers or college trainees.

(6) The demonstration and evaluation of these training systems within the contexts of elementary school, secondary school, and college classrooms and especially behavior analysis laboratories that may be found in schools of education or teacher centers.

Project 2.2.3.1: Design, Install, Evaluate, and Then Expand the Services of a Regional Teacher Education Laboratory to Provide Computer-Assisted Training Systems to School Districts and Teacher Training Institutions Within Reach of Telephone Networks (or Satellites in 1975). The six objectives listed for Program 2.2.3 are sufficient to describe the activities of a systems laboratory for the first few years. As one might expect, providing more powerful tools is likely to generate new objectives which cannot now be anticipated.

One of the more powerful arguments in favor of this program is the potential of the system for facilitating the regular evaluation of its own program. When a computer-assisted teacher training system is in operation, it should be possible to print out data which summarizes the extent to which trainees were able to modify the interaction patterns of their teaching.

Project 2.2.3.2: With the Resources of a Teacher Education Laboratory, Examine the Utility of Knowledge About Teaching and Evaluate the Extent to Which Motivated Adults Can Implement This Knowledge in Their Teaching. All of the research activities described in Approach 2.1 have the ultimate purpose of improving education. Although deciding what is to be an improvement is both a philosophical and, to some extent, a political issue, one can at least ask whether the learning of this knowledge appears in the interactive contacts of teachers with their pupils. Or, given two alternative curricula in the field of teacher education, or even two comparable units of study, which is more likely to affect the interaction of the adults whose teaching is to be improved? One might propose the criterion that knowledge of pedagogy must appear in the overt behavior of a teacher, sooner or later,

if it is to improve the educational opportunities of pupils. The justification for such a criterion might be that there must be a change before there can be an improvement and a great many of the changes that lead to improvements, if not all, do affect the interaction processes.

Project 2.2.3.3: Develop and Evaluate Services for School Districts Which are Required by Law to Evaluate Their Personnel in Terms of Effective Human Interaction. With the dissemination of performance based teacher education has come the notion that school districts should evaluate educational personnel in terms of performance objectives. Some of the more important performance objectives are likely to involve an analysis of teacher-pupil interaction. These developments raise a number of questions to which research should respond:

1. Can we distinguish more effective teachers from less effective teachers by analyzing verbal interaction from recorded specimens of teaching?

2. Can the quality of education be improved more by assisting teachers in the analysis of their own interaction than by sending in specimens which then are analyzed by someone other than the teacher?

3. Do research workers have any responsibility to influence or even monitor the activities of those who are required by law to make judgments about the relative effectiveness of teachers?

There has been a remarkable indifference on the part of well qualified researchers when the above questions are raised. It is the opinion of this Panel that NIE should support programs which respond to the concerns of our own constituents, as well as pursue "truth" for truth's sake. It is a fact that some teachers, whether they like it or not, are being evaluated in terms of performance objectives by supervisors, who also may or may not like it, in order to comply with a state law. We propose that NIE support projects which can turn these laws to the best advantage by exploring evaluative activities which have the highest likelihood of improving education.

This topic is placed in the Report at this position because the activities of teacher evaluation which are connected with the analysis of human interaction can best be carried out from a laboratory which has computer-assisted encoding and decoding capabilities. Thus, another project which we are proposing is that school districts be provided with services designed to help that district "make the best of" laws or regulations that involve teacher evaluation.

APPROACH 2.3

ISSUES OF METHODOLOGY, INSTRUMENTATION, AND PROFESSIONAL COMMUNICATION

Panel 2 found itself in reasonable agreement about what should be studied and in fairly consistent disagreement about how topics should be studied. This situation may reflect, for better or for worse, our professional commitments to methodology which are probably stronger than our commitments to topics. Our preferences were easy to identify: some preferred the laboratory, others preferred the field; some preferred natural behavior, others preferred to have behavior manipulated or persons trained to act in a particular way; some preferred true experiments, others correlational studies; some preferred to measure everything at once, others preferred to "control-out" rather than "control-in"; some preferred reasonably short (two- or three-week) units of study with controlled instructional materials, others preferred the regular curriculum materials.

Two members of the Panel stated clearly on the first day that the best way to improve research on teaching is not to name topics that should be investigated but to specify acceptable standards of research design, operational definitions, instrumentation, reliability, data collection safeguards, acceptable versus unacceptable statistical analysis, and adequate reporting and publishing of research activities. There was a general nodding of heads, suggesting considerable agreement.

AREAS OF METHODOLOGICAL AGREEMENT

Panel 2 believes that research on teaching can be significantly improved if certain design features relevant (or potentially relevant) to any study in the area are given systematic attention in research planning or funding decisions.

Research will be improved if, during planning, researchers systematically determine

a. Whether or not each design feature is relevant to the proposed study; and

b. if it is relevant, how it can be taken into account so that the study will be designed in a way most likely to produce clear-cut, replicable results.

This way of planning is vital because failure to take these design features into account usually means that teacher-student interaction effects are masked by differences in such variables as pupil ability, SES, attitudes, or other factors that may be irrelevant to the purposes of the study but may strongly influence its data.

Some of the design features to be discussed are relevant to any study but have special relevance to research on human interaction; others are unique to this area of inquiry. Before beginning the entire listing and discussion of these design features, we wish to highlight and lay special stress on four design features which appear especially crucial.

Programmatic, Cumulative Research

High priority, other things being equal, should be assigned to studies which form part of a programmatic effort to generate knowledge about a particular problem or set of related problems. Ideally, such research would involve studies which cumulate knowledge in the area, relating presage, process, context, and outcome variables to one another; moving from naturalistic observation and correlational designs to experiments allowing causal inference; and building theories or networks of descriptive and explanatory concepts which integrate the empirical data. One response to these problems is a coordinated program of research by a highly qualified research team supported over long periods of time.

Multiple Outcome Measures

Studies involving prediction or measurement of outcomes, of either teachers or students, should include multiple measures of a variety of outcomes. Further, the selection of measures and criteria should flow logically from the basic purposes of the study (as opposed to selection based on convenience, common usage, ease of administration, or other logical but irrelevant reasons).

This point is especially crucial in studies involving pupil gains in achievement. Standardized achievement tests should not be used (or at least should not be used alone) except where they are logically appropriate, i.e., where they correspond to the goals and content of the curriculum and are appropriate for use with the students in the sample. This correspondence of standardized achievement tests is not ordinarily the case, yet standardized achievement tests are the most common criterion used to measure learning gains. It seems likely that the problem of alignment of curriculum and objectives measured by standardized tests may become more difficult at higher grade levels.

Instead, a variety of outcome measures selected for their relevance to the study and the sample to be measured should be used. Measurement of learning gains should involve pre- and post-testing of content mastery at selected levels of complexity (from simple to abstract) or generality (from factual memory to transfer and generalization). Whenever the processes of interest are known to have different effects on different aspects of learning, the test battery should be designed to reveal change in each relevant aspect.

Also, studies concerned with gains in achievement of cognitive objectives should routinely include measures of other effects, particularly effects on teacher-student and student-student interaction process variables and teacher and student affective variables (morale, classroom climate, school attitudes, etc.).

In short, it is now clear that particular classroom processes (including systematic changes introduced in experiments on teacher training programs) often have different effects on different outcome variables. Sometimes gains in one area are achieved at some cost to other areas. Therefore, it is essential that multiple measures of a variety of relevant outcomes be included routinely in planning research concerned with outcomes.

Nonlinear Relationships

Most correlational designs have been limited to the search for linear relationships among variables. It is now clear, however, that many variables have replicable and orderly but nonlinear relationships.

One common and important curvilinear relationship is the "Inverted U" relationship, which indicates that either too much or too little of a classroom behavior is less desirable than some medium amount which produces optimal results. For example, it appears that such variables as indirect teaching styles, question difficulty, and pupil freedom to select classroom activities, among others, are related to student learning gains in this fashion.

It seems likely, and has been shown in a few studies, that many other variables have threshold relationships to outcomes; i.e., they are linearly related up to a point, but beyond this threshold point further increases in the variable do not affect the outcome one way or the other.

Knowledge about nonlinear relationships would probably be much greater already, except that few investigators have bothered to look for them. Because methods and statistical programs which facilitate this process are now easily accessible, checking for nonlinear relationships should be included in data analysis plans routinely.

Complex Interactions Among Variables

Several studies have shown that variables sometimes interact with one another in complex (and often nonlinear) ways, so that certain combinations of variables have clear effects even though the individual variables considered separately do not. Variables may act, for example, as suppressors or moderators vis-a-vis one another or may show effects only when present in some critical combination.

Thus, in addition to looking for both linear and nonlinear relationships involving individual variables, researchers should check for the existence of interactions of at least two variables at a time. A simple example is the finding that low and high social status pupils respond in differing and sometimes opposite ways to increasing amounts of the same classroom behavior. A more complex example is the finding that teachers high on one measure of classroom control and low on another differed systematically from teachers with the opposite pattern, although analyses of each control measure in isolation failed to reveal significant relationships. In short, some variables appear unimportant when viewed alone, but they may have very important effects when their interactions with other variables are taken into account.

Other Relevant Design Features

This section will indicate classes of variables which may affect the results of naturalistic and experimental studies and will provide examples of how they should be taken into account in planning research. Taking these design features into account may mean:

1. Systematically measuring them and reporting their interactions with other variables.

2. Systematically controlling them through sample selection:

   a. Restricting samples to one or more types.
   b. Using different intact groups.
   c. Keeping different data sets separate from one another and analyzing them separately.
   d. Explicitly recognizing the restrictions which may have to be placed on generalizing from the results to other teachers, students, settings, etc.

3. Replicating findings from one type of teacher, student or setting to different types.

Analyze the distribution of gains. A question worth investigating is "Where does the teacher get his gains?" That is, does the mean residual gain for the class represent the gain for boys and for girls equally well, or is this teacher notably successful with boys and unsuccessful with girls? or vice versa? with students of high rather than low ability? with dependent and passive students only? Such questions concerning the interaction between teacher effectiveness and individual differences among students have barely begun to be investigated, but the few available data suggest that they are important and worthy of investigation in any process-product study.

Use residual gain measures of student outcome (based on raw pretest and posttest scores). If teacher success is judged by gains from pretest to posttest scores on measures of outcomes in students, investigators should be sure to use residual rather than raw gains as their criterion for teacher effectiveness. The measurement of gain is an exceedingly difficult problem, the solution of which is not agreed upon by measurement specialists. Among the possible problems is the likelihood that regression will differ for the sexes or for different social status or ability groups, and may differ for different ethnic groups. Non-linearity is not unlikely. All that is intended here is to caution the unwary, since the problem is too large and too uncertain to allow the specification of simple standardized procedures to solve it.

Include both high- and low-inference measures of process behavior. Low-inference coding systems provide the most objective kind of measurement of teacher behavior, but they are most suited to specific sorts of teacher behavior. Rating scales or other high-inference measurement methods are required to get at certain kinds of teacher attributes which cannot be measured validly by counting their frequency but instead must be measured by rating the teacher on a more general scale (variables such as warmth, enthusiasm, interest in the subject matter, organization, and orientation towards students).

Such general teacher variables have so far defied successful measurement through low-inference coding, but they can be quite reliably and apparently validly measured with high-inference ratings. High-inference ratings, however, are notoriously vulnerable to halo effect, logical error, and rater bias. Most important, high-inference measures are difficult to translate into specific behaviors useful as objectives in the improvement of instruction. Hence investigators should not rely on high-inference ratings alone.

Match classrooms. Even with the use of residual gains, investigators are well advised to randomly assign classrooms or to match classrooms on relevant student variables, particularly initial scores on the criterion tests. If random selection or assignment procedures are used, the investigator should check to make sure that the procedures were effective, especially where N is low and the potential for problems due to non-comparable samples is high.

Use a large sample of teachers. This is necessary in part because the idea of using the teacher as the unit of analysis requires that the sample include at least 30 or so teachers. A study of Cohen's power tables, published in 1969, indicates that a study involving 15 classrooms has a probability of only .3 of finding a relationship significant at the five percent level if the population correlation value is +.30.

Use a rationally selected rather than a randomly selected teacher sample. Most process-product studies to date have used teacher samples selected either on the basis of convenience (they were available and willing) or on a random basis. Neither method is as useful for this kind of research as the use of a sample carefully chosen on the basis of its appropriateness for the study. For example, in planning a naturalistic study intended to relate observed teacher behavior to student gains on specified outcome measures, a carefully selected sample composed of teachers whose students over a three- or four-year period had consistently shown gains on the outcome measures would be preferable to a random sample of teachers. The consistent-gain group would be composed of teachers who were experienced at their grade level, and who probably had established a style or pattern of teaching which reasonably could be expected to continue and to have roughly the same relative success as in the previous years. In contrast, a random sample of teachers would include a number of teachers who were highly inconsistent (for unknown reasons) in their effects on students from one year to the next, as well as a number who were changing their teaching styles because they were new to teaching, new to the grade level, or experiencing difficulty in adjusting to some problem.

Collect enough data to insure reliability and validity. The quality and quantity of process behavior data collected should be sufficient to insure reliability and validity. For example, not much confidence can be placed in data based on only one or two visits to the classroom, because of the many different situational and contextual factors that could influence a teacher's behavior during a given hour or day. It may be desirable to visit the teacher's classroom many times and in many different contexts (mornings and afternoons, different days of the week, during introductions to units and during completions of units, etc.). For example, in a series of studies of teacher expectations and attitudes conducted at the early elementary grades, it became evident that the quality of teacher-student interaction during reading groups was different in many ways from the quality of teacher-student interaction during whole group discussions. Consequently, separate measures of the same kind of behavior were developed and used for these two different situations (Brophy and Good, 1974).

Another alternative is to ask teachers to teach standardized lessons in each classroom. This is generally a good method to the extent that:

(a) the standard lessons are identical for each teacher;

(b) the standard lessons are equally relevant and appropriate for the students in each classroom;

(c) the standard lessons are taught and observed under standardized conditions (time of day, day of week, time of year); and

(d) instructions about what and how to teach are sufficiently detailed and explicit to insure that all teachers will have the same goals in teaching the lesson (see below).

Long-Term vs. Short-Term Studies. Although much past work has been based on periods ranging from a few minutes to a few weeks, it is not clear that these short-term studies can be generalized to longer-term learning. Some evidence (Soar, R.S. and Soar, R.M., 1974) suggests, for example, that the classroom behavior related to achievement gain over the summer out of school is different from that related to gain during the school year. Study of longer periods of growth thus seems highly desirable.

Monitor Implementation. Experiments involving systematic control of teacher behavior should include observation to measure the degree to which teachers actually are behaving as instructed, and these data should be taken into account in evaluating the results. Where implementation was poor, post-experimental teacher interviews should be conducted to find out why (Unclear about instructions? Emotional resistance? Complexity or difficulty of the experimental behavior? Negative experiences the first few times which led to loss of attempt to implement? Too many conflicting duties?).

Such data add richness and validity to experimental results and implications, whether or not the predicted outcomes were observed.

Control for Experimental Participation Effects. Studies involving experimental manipulation or treatments should control for the "Hawthorne Effect" among experimental subjects and the "John Henry Effect" among control subjects.

The easiest way to obtain such control is to produce "Hawthorne Effect" in all groups by giving each group specific experimental instructions, thus avoiding a "control" group with no special instructions (assuming, of course, that the various treatment groups involve no violations of ethical standards).

Insure Adequate Variance. Especially in naturalistic studies, investigators should try to insure in advance that their sample(s) include sufficient variance on the variables of interest. If the classroom interaction does not involve enough instances of the interactions of interest, or if there is very little variance across classrooms on measures of interest, no significant findings can be obtained.

Stability of Teacher Behavior. Student teachers and teachers trying out new curricula or methods are unstable until they settle into a characteristic pattern, and even experienced teachers vary their behavior across settings. Where a study assumes that particular behavior is a stable teacher characteristic, care should be taken in sample selection and in controlling for context effects to insure that such stability is in fact present. The more frequent and stable the behavior of interest, the less data must be collected.

Initiation and Sequence of Interactions. Teacher-student interactions are initiated by either the teacher or the student, and they usually involve sequences of initiation and reaction. Interpretation of the meanings and implications of data on such interactions is usually ambiguous unless information about initiation (teacher or student) and sequences (e.g., the events that preceded and perhaps directly caused the interaction) are taken into account.

This problem is especially important when groups of students of different sexes, races, etc., are compared. For example, one group may be praised more often because its members continually come to the teacher to show their accomplishments and seek praise, while the other group does this minimally. Here, the group difference in teacher praise reflects a student difference, not a difference in teacher liking or appreciation for the two groups.

Devising Scoring Systems Which Allow Direct Comparisons. Simple frequency counts of types of interactions often cannot be compared meaningfully. For example, the fact that one student is praised 12 times and another 4 times during the observational period is relatively meaningless by itself. Interpretation requires that initiation and sequence be considered (see above), as well as differences in student performance. Consideration of the latter leads to the creation of percentage scores which are more directly comparable than raw frequencies are. For example, assume that all the praise noted above occurred following correct answers by the student. Conversion of the raw frequencies to percentage scores facilitates direct comparison. Thus, if the teacher praised 12 out of 100 (12%) correct answers by the first student, and 4 of 32 (12.5%) correct answers by the second student, her praise rates relative to student performance would be seen as equivalent despite differences in raw frequencies.

Percentage indices such as these should be devised and used in preference to raw frequencies when the frequencies are ambiguous or misleading.

Decisions About What to Measure and How to Measure It Should Flow From Project Goals. Too often, measurement devices and analysis methods are used simply because they are available, convenient, etc., rather than because they are suited to the goals of the project. Hence, results are irrevelant or misleading. Data gathering plans should take these goals into account to insure that the data collected are the data actually needed. Often this kind of relevance to goals can be achieved by using an available system, but sometimes it will mean modifying a system or creating a new one.

METHODOLOGICAL PROGRAMS AND PROJECTS

The recommendations which follow are concerned with methodological problems that need to be resolved. Whether these resolutions are the product of a methodological study per se or a substantive study designed and carried out in such a way that the methodological problems are resolved is a matter of no consequence. Perhaps the policy for NIE to follow is that the programs and projects it funds should contribute in some way to solutions to the problems about to be described. If this policy proves difficult, then it may wish to commission the design and conduct of a methodological study.

The two highest priority nominations for methodological studies have already been described. In Program 2.1.1, this Panel described projects to create a new generation of research variables based on human interaction. In Program 2.1.4, this Panel described the need for a wide variety of outcome measures and an escape from excessive dependence on tests of subject matter, especially nationally standardized tests of achievement. In this section we will discuss additional, perplexing research difficulties.

Program 2.3.1: Commission a Task Force of Qualified Researchers to Clarify and Illustrate the Issues Related to Choice of Units of Sampling, Populations, Universes, and Degrees of Freedom in the Analysis of Interactive Behavior.

Project 2.3.1.1: Examine the Problems Connected With Sampling and With Generalizing From Samples. Under what circumstances should the unit of sampling be the teacher? The student? A behavior episode? Patterns of behavior? A single behavioral event? What kinds of inference are possible with the various sampling units and associated research designs?

Is there any such universe (or population) as male, third grade teachers? Can it be sampled? What line of argument is used to show that the sample is representative of the universe? Part of the problem here is to demonstrate how a practical universe connected with research on teaching can be defined and its boundaries specified.

The argument is sometimes advanced, currently, that the classroom is the only acceptable unit of analysis because pupils within classrooms are not independent of each other. Yet there is evidence of a school effect (that is, classrooms within a school are not independent), a system effect, a regional effect, and probably a national effect. The prescription that the classroom is the only "proper" unit seems to oversimplify.

Given a sampling unit, like teachers or classrooms or instructional strategies, what are some practical guides to obtaining a valid and authentic sample of the behavior of that kind of unit? For example, one member of our panel was given access to the classrooms of all 74 fourth-grade teachers in a single school district. Because some teachers resented the study or were fearful, it became evident that some curtailed their behavior during the visits of an observer. Thus, the sample was complete, but the interaction was not representative. It is possible that the interaction in the classrooms of volunteer teachers would be more representative. What are the trade-offs between sampling theory and the practical politics of obtaining access to valid data?

Project 2.3.1.2: Examine the Problems Connected With Defining a Unit of Behavior. Every event has a beginning and end; thus, it has both a quality and a duration. The duration of events of the same quality can be highly variable. Under these circumstances how does one define a unit of behavior which can serve as a common unit in statistical analysis? We should keep in mind that units of time can vary at least between a microsecond and more than a lifetime. The nature of an event, that is, its quality, may be technically independent of its duration, but in practice the two are very interdependent. For example, criticism directed toward one child when it occurs as a single word differs greatly from that consisting of a two-minute speech.

Project 2.3.1.3: Examine Problems Connected With Studying Time Series, Chains of Events, and Models for Conceptualizing Chains of Events. Appropriate procedure should be used to develop a mathematical model that will serve as a useful analogy to a series of behavioral events. The assistance of mathematicians familiar with the field of stochastic processes should be obtained to develop methods for analyzing the chains of coded events which are used to represent human interaction.

Program 2.3.2: Investigate the Nature of Errors During Encoding Procedures, and Develop a Model for Understanding Errors That Can Serve as a Guide for Different Encoding Systems and Can Show How to Demonstrate the Effects of Errors in the Analysis of Human Interaction.

The problems of analyzing observer error are vast and complex. No one has even attempted to characterize these problems in the field of research on human interaction. For example, there is no category system for classifying all types of observation errors. One encouraging trend is the development of computer-assisted encoding and decoding. The problems are so difficult that they should be attempted only when a completely computerized system is available.

Program 2.3.3: Develop the Means for Assuring Communication and the Sharing of Data, Methods, and Substantive Results Concerning Research on Teaching.

In this program, the Panel makes a series of recommendations aimed at improving communication between researchers, between researchers and practitioners, and between researchers and those who administer and support research activities.

Research on teaching is very active; literally scores of studies are being completed each year. If more adequate support funds became available, the number of studies would be even greater. At present, unfortunately, no adequate means are provided for gaining access to this research effort. No journal is published for the field of teaching research; no ERIC Clearinghouse collates its methods or findings. In addition, no depository or data bank presently exists that can provide access to its expensive data for scholars who cannot afford to collect their own. And, if this were not enough, standards for publication of research in this field (and other, related fields) are sufficiently chaotic to make it very difficult for the researcher or practitioner to evaluate findings, on the one hand, or to publish his research, on the other. These problems argue for serious efforts on the part of NIE and the research community to institutionalize means for assuring communication and the sharing of data, methods, and substantive results concerning research on teaching.

Project 2.3.3.1: Support an ERIC Clearinghouse for Research on Teaching. The educator and researcher who wishes to gain access to literature concerned with research on teaching faces a formidable task. For one thing, research of concern to him is likely to be published in any of literally hundreds of sources. For another, its quality varies. For another, the vocabulary with which it is expressed may be unfamiliar to him, for research from a variety of disciplinary traditions may bear on the practical problems with which he is concerned. And again, much

of that research is likely to be reported together with advocacy and interpretation, so that it is difficult for him to separate the actual findings from the claims. A minimal response to the solution of this problem would be the setting up of an ERIC Clearinghouse concerned with studies of teaching. Such a clearinghouse would provide access to literature in this field, which could be indexed for findings, methods used in studies, sample characteristics, and other features of research needed by users. Establishment of such a clearinghouse is an urgently needed first step in gaining control over knowledge in the field of research on teaching.

Project 2.3.3.2: Commission Regular Reviews of Research on the Processes, Causes, and Effects of Teaching. Information retrieval is only part of the problem of studying and profiting from research on teaching. Most educators are not equipped to disentangle the intricacies and deficiences of research on teaching -- or of any other complex field of educational research. Moreover, educators need "friends in court" who will sort out the facts from the claims and who are willing to give a reasoned judgment concerning what is now known and not known about research on a given problem in education. Partial solution to this problem has been provided by both volumes of the Handbook of Research on Teaching and recent issues of the Review of Educational Research. Unfortunately, however, both of these sources are addressed more to researchers than to practitioners. Several years ago the Office of Education was commissioning reviews of specific subfields of research for consumers, but these grants seem to have fallen on evil days. Perhaps the best recent reviews of research on teaching have been provided by several, independently-authored texts. These will rapidly become obsolete, however, and additional review sources are needed on a regular basis.

Project 2.3.3.3: Establish and Support a Journal for Research on Teaching. Unfortunately, no journal (as distinct from newsletter) is now published that devotes itself to research on teaching. Sufficient research is surely available to justify such a journal, and it is likely to receive wide adoption among educators. It is suggested that such a journal be established under the sponsorship of AERA or some other suitable organization. An initial grant would presumably be needed to get the journal off the ground, but thereafter the journal should become self-supporting.

Project 2.3.3.4: Commission One or More Conferences Concerned With Standards for Scientific Publication in Research on Teaching and Allied Fields. This project is aimed at the problem of control over the reporting of research on teaching and allied topics. Present standards of reporting in this field are chaotic. The problems include failure to describe research instruments, failure to estimate the reliability of data, misuse of inductive statistics, failure to

interpret findings that appear in data tables, and failure to publish results. The foregoing complaints are further complicated by page restrictions and the resultant editorial policies against long articles and elaborate data displays.

Such problems will be alleviated only when a series of prestigious journals agree to set and enforce standards for the publication of research on teaching and related fields. It is suggested that one or more conferences be commissioned, probably with the help and sponsorship of prestigious professional organizations. Such conferences would bring together the editors and editorial boards of a number of journals. The conferences would be encouraged to set, and thereafter enforce, common standards for publication.

Project 2.3.3.5: Establish and Support a Data Bank for Basic Data From Studies of Teaching. Data concerning the processes of teaching are expensive to collect and interpret. Often such data begin life as video or audio recordings. These recordings are then typewritten as lesson transcripts and may later be coded and interpreted with a variety of instruments and procedures. Data from a given lesson, then, may be available as a tape recording, as a transcription, or in any of various forms as coded data. Such data are expensive, seldom costing less than $100 per lesson for the investigator to collect and prepare. In addition, such data may be accompanied by a wide variety of context, presage, and product information that may be paired with process data in subsequent analyses. At present data in these forms is seldom shared between research centers. This lack of sharing does not mean that researchers are unwilling to share their data. On the contrary, most investigators are glad to share their data with others, once their initial use of those data has been completed. But no mechanisms presently exist for the sharing of data; thus researchers are always required to collect new data where old tape recordings, transcriptions, or codes from another research center might have sufficed for the researcher's purposes. Considerable savings, as well as the multiplication of studies from data already collected, can be effected by establishment of a data bank for research on teaching. Such a bank would solicit the deposit of data from studies of teaching already conducted and would specify the standards for deposit of those data. Data would be offered to other investigators on a cost basis. Researchers would be induced to deposit their data by suitable means (perhaps by writing stipulations into their research contracts or by providing them with a cost rebate whenever their data were used). Establishment of such a data bank will require both an initial and a small sustaining grant. In time the data bank may become self-supporting.

SUMMARY

This panel was concerned with variables in six categories: teacher-student interaction, educational outcomes, student characteristics, the social context, teacher characteristics and plans, and teacher education. The panel was further concerned with categories of variables involved in research on teacher education. These categories included interaction between instructors of teachers and their adult trainees, the interaction between the teacher trainees and their students, the knowledge and skills acquired by the trainees, the procedures for feedback to the instructors or their trainees, characteristics of the setting, and teacher plans and characteristics.

Millions of students -- ranging in age from six to eighteen -- are required by law to interact with teachers for hundreds of hours every year. That requirement, if nothing else, imposes a moral obligation on the whole society, and especially its professional educators, to make that interaction as beneficial to the students as possible. Panel 2 was aimed at planning research and development toward this end. It worked in an area of research on teaching that has received more attention and effort during the last fifteen years than any other. In this area, some relatively substantial results have been achieved, and the personnel and methods are ready for major advances. Panel 2 attempted to lay out approaches, programs, and projects that would result in such advances.

The first approach dealt with teacher-student interaction. Five programs were set forth. The first dealt with the study of interaction in itself -- the dimensions along which it should be described, and the kinds of descriptions that should be made. The second emphasized educational settings and student characteristics in their relationship to interaction processes. The third emphasized the study of teacher characteristics, plans, and perceptions of students in relation to interaction processes. The fourth laid out studies of the ways in which interaction processes are related to the educational growth of students. The fifth dealt with studies in which the whole complex of interdependent variables involved in teacher-student interaction would be studied in multi-faceted designs.

The second approach of the panel was concerned with teacher education. Here, three programs were set forth. The first dealt with the ways in which teachers think about interaction, their own participation, and the ways in which they decide to participate. The second was concerned with the capacity of a motivated adult to receive and use feedback while interacting with students. The third was concerned with computer-assisted systems of teacher education -- their design, development, and evaluation.

The third approach, related to the concerns of Panel 9 (Research Methodology), was concerned with the special difficulties of research on teaching as human interaction. The Panel recommended special efforts to develop (a) additional measures of the outcomes of teaching and learning,

(b) mathematical models for dealing with chains of events in classroom interaction, and (c) a position paper on the unit of sampling, units of behavior, and similar problems in this research area. The need for replication of findings was emphasized, along with the need for long-range, coordinated programs which make use of laboratory and field studies. In addition, the Panel recommended the establishment of various kinds of data banks that would facilitate comparison of various systems of interactive analysis on the same data, comparisons of various sets of predictive variables, and the creation of samples large enough to make possible cross-validation of results.

Finally, the Panel emphasized the need for taking into account the ways in which teachers will adapt research-based knowledge and teaching skills to their own classrooms, students, and styles. Such adaptations will determine the validity and utility of the knowledge to be derived from research on teaching as human interaction.

STATEMENT OF PRIORITIES

As a final task, members of the Panel were asked subsequent to the Conference to send in their nominations for highest priority research problems. The Panel nominated Program 2.1.4 and Project 2.1.4.1 (process-product knowledge) as the highest priority in Section 2.1. They nominated Program 2.2.2 and Project 2.2.2.1 (ways to improve feedback to adults in teacher education) as the highest in Section 2.2. The recommendations for Section 2.3 were more scattered. Some registered their concern for general problems of research methodology by listing Approach 2.3 itself; but there was strong second rank order support for 2.3.3.1 (an ERIC clearinghouse for research on teaching) and 2.3.3.3 (a separate journal for research on teaching). One way of summarizing these preferences is that: (a) we need higher quality knowledge about the effects of teacher influence, from both laboratory and field settings, and (b) we need to test the utility of this knowledge for all kinds of educators, but especially teachers, as an integral part of the responsibility of researchers.

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